Designing and managing operations in innovative multi-channel retailing systems

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Abstract: The growing expansion of both brick and mortar and virtual retail channels creates a wide range of customer physical point of sales, e-commerce sites integrated by social media commerce, catalogs and possibly seasonal or short-term locations. This phenomenon is modifying traditional as well as e-commerce retailing models towards the so called multi-channel and omni-channel retailing. In omni-channel retailing systems, physical and virtual stores are managed in a coordinated and synchronized level: thus, order fulfillment process becomes extremely critical due to several factors. Furthermore, in these systems the whole supply chain has to focus its efforts to "serve" *one single shopper* that could define an order in *each moment of a day*. The paper proposes a critical analysis about different organizational models that could support an effective omni-channel retailing. Logistic structures and inventory models proposed in the scientific literature have been analysed in order to evaluate most critical factors affecting the operations design and management of "more than one channel" retailing systems.

Keywords: multi-channel and omni-channel retailing, fulfilment, inventory management, return policies.

1. Introduction

In the past years, brick and mortar retailers were rushing to develop online stores and e-commerce models become popular. The new reverse phenomenon could be outlined in these recent years: retailers started their business online are now migrating to the real physical world, where customers can touch, taste and try on their goodies, i.e. the so called "brick-and-click" model (Agatz et al., 2008). One example is an electronics store that may allow the user to order online, but pick up his order immediately at a local store, which the user finds using locator software. Thus, integrating virtual with physical channel (and vice versa) is an emerging strategy for retailing companies: it has to be noted that integrating the two channels is easier for traditional retailers who have extensive logistics and supply chain network; on the other hand, establishing a traditional presence for an online company could be a more complex task as the whole supply chain has to be fully re-designed. The diffusion of mobile technology is now enabling new customer requirements thus forcing retailers to provide goods from different purchase channels. New organizational structures have to be defined in order to support a more comprehensive customer experience; new business operations are also required by retailers. Cross-channel and omni-channel retailing systems are becoming popular: they refer to new retailing models sustaining a seamless shopping experience. Integrating technologies such as in store kiosks or tablet computers, within an omni-channel approach, can create a more interactive and immersive retail environment for the customer (Elia and Gnoni, 2010), while at the same time improving productivity on the shop floor.

The paper proposes a critical analysis about how the innovative retailing business models could affect the overall performance of operations management of a retailing supply chain. Zhang et al. (2010) outlined as fulfilment process, inventory management and return policies are the most critical processes when retail companies evaluate to move towards innovative retailing systems. They are deeply discussed in the next paragraphs.

2. The fulfillment process in current retailing systems

Retail supply chains are basically focusing on the order fulfilment which includes the following processes:

- *sale management*: it refers to activities involving directly customers (e.g. demand management, item availability, pricing allocation, etc.) usually carried at physical stores in traditional retailing systems;
- *purchase*: it refers to all supply activities, notably ordering of final products;
- *warehousing*: it refers to the physical storage and handling of items to be delivered to final customers;
- *delivery*: this process has to involve both direct (i.e. from companies to the final customers) and reverse (i.e. from customers to companies) deliveries as managing effective return policies is a key point in multi-channel retailing.

All processes are strictly dependent on the specific organizational structure developed by the retail company. Furthermore, critical issues characterizing traditional

physical retailing systems as well as e-commerce companies are amplified when more than one retail channel is working (Yan et al., 2011). An example is the picking process which usually represents the largest part of warehousing operating costs (De Koster et al., 2007) at the storage facility: when the retailing process is carried out on more than one channel, its criticality heavily increases. Thus, each previous process of the order fulfilment will be analysed based on current organizational retailing structures applied worldwide.

2.1 Classification of retail models based on channel structures

The evolution of current retail sector is forcing a wide range of customer point of sales (POSs) based on virtual and/or physical stores. Thus, different sale structures are now emerging all over the world aiming to support an increased customer service level; the traditional single channel is now integrated by other three structures defined as *multi-channel*, *cross-channel* and *omni-channel* retailing (or distribution): they are used often with similar meanings but each of them is characterised by specific features influencing retail operations design and management: a critical analysis is proposed as follows. The main differences are in Figure 1.

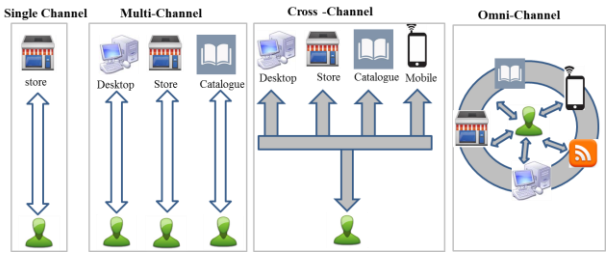

Figure 1: sale channels in the retailing sector

Differently from single channel, in *multi-channel* retailing, sales are enabled through different channels (shops, catalogues, internet, mobile, etc.); however, as depicted in Figure 1, each channel manages its own information about goods (e.g. price, product availability) and customers (e.g. payment types); no interaction between them is allowed. According to an operations point of view, each channel is managed independently - e.g. with a dedicated supply chain - and it is not directly connected with other ones. Customer service levels increase in multi-channel retailing as different options are available to customers for completing each single purchase order process. Recently, due to the rapid diffusion of mobile and social technologies, two innovative business models are becoming popular in the retail sector: cross-channel and omni-channel retailing. These two models are more customer-oriented than the previous ones as an increased customer experience is provided; on the other hand, they also require a higher effort from retail companies due to an increased level of integration required for business operations. Differently from multi-channel, the customer in *cross-channel retailing* could use a combination of several different channels for carrying out the same purchase (Chiu et al., 2011; Heitz-Spahn, 2013). An example is when a customer books an item on the company website and buys it directly at the store. Finally, *omni-channel* usually refers to an evolution of cross-channel retailing as the use of different channels is simultaneous, e.g. a customer using a mobile phone device for buying in store and booking delivery directly to its home. Differently from other models, omni-channel retail applies integrated sale strategy across every sales and service channel, where each channel is maximised in terms of its ability and in line with the way customers wish to interact with it. By analysing from an operational point of view, omni-channel and cross-channel retailing requires a high level of integration is required as customers have to interact via the different channels: as an example, configurations and choices made on one channel must be memorized and considered for each channel. Furthermore, companies have to trace customers' purchases across all channels: inventory visibility is becoming essential for supporting these business models as companies must be able to combine data from in store and online channels (Schneider and Klabjan, 2013). Cross-channel inventory visibility is also critical to both retail and supply chain operations as it affects performance characterizing in store pick up process as well as supplier and distribution replenishment processes.

2.2. Classification of retail models based on warehousing and delivery processes

Classifying retailing models based on the *delivery* process outlines three paths (based on customer point of view) which are detailed as follows:

- "*buy in store, pick up in store*": it usually refers to the single channel model where the traditional purchase process is carried out in brick and mortar retailing;
- *"buy in store, deliver to home":* it refers to the home delivery of products bought in store. It is generally an additional service of the traditional retailing but, from a delivery point of view, it must be considered as a specific path.
- "*buy online, deliver to home*": it refers to a single channel model where e-commerce is the only sale channel;
- *"buy/book online, pick up in store*": based on the level of integration, it could refer to cross-channel or omni-channel models. The customer could buy or book the product online through different channels (e.g. mobile, website, etc.); product delivery is in the physical store. The only difference for customer is the payment that can occur online or in the store respectively. An evolution of "buy online, pick up in store" is the new phenomenon of "parcel locker" for the pickup of purchases at a prearranged collection point, a service aiming to simplify the delivery cycle especially in big cities. They are part

of networks of automated parcel stations, where people can withdraw packages 24 h a day from locker boxes usually located in shopping centers, gas stations, train stations or on the street (Morganti et al., 2014). The distribution company carrying out this service, collects goods from vendors and delivers them to the locker selected by customer who receives the code for pick up through e-mail or sms.

By analysing the *warehousing* process in a retail supply chain, different logistic structures could be applied:

- a *traditional retail supply chain* with one large (or more) distribution centre or central warehouse (CW) and several POSs (i.e. the store network). Stored quantities at POSs are usually limited; order fulfilment from POSs to the distribution centres are based on sales levels;
- a *fully-internet retail supply chain*: for each product listed on the web site, retailer carry inventory on it in order to make visible the availability of each product. Products bought online are shipped to customer home from one distribution centre. Otherwise, online orders are managed by a third party provider for fulfilment. One interesting example is the "drop shipping" model (e.g. applied by Amazon): when a consumer places an order with an online store, the retailer splits the contents of their shopping cart into multiple separate orders which is managed separately by the supplier of the product. The supplier then ships the item directly to the consumer address using packaging materials supplied by the retailer;
- a *mixed retail supply chain* where warehousing and POS are located in the same facility, e.g. the Ikea model. This structure aims to overcome limits of traditional retail supply chain where product ranges at POSs are limited, and items need to be ordered, delivered and installed thus causing a longer order fulfilment time.

Considering the storage location of products and the places where they are physically taken by the customer, four logistics paths linking *warehousing* with *delivery* emerge:

1) *from CW to POS*, e.g. in the brick and mortar retailing and in "buy online, pick up in store" when the product bought online by consumer is shipped from the nearest central warehouse where it is available to the store chosen by the customer for pick up (e.g. "Click and Collect" by Decathlon);
2) *from CW to customer,* e.g. in e-commerce channel characterised by home delivery; products move from the great central warehouses to customer home;
3) *from POS to POS,* e.g. in brick and mortar retailing, when the item the customer wants to buy is not available in that store and so it is shipped from another one, and in "buy online, pick up in store" in the event that it is more convenient, from firm point of view, carry a product to a POS from a nearby POS rather than the CW;
4) *from POS to customer,* e.g. home delivery of bulky and/or heavy products bought in store.

This paths are characterized by parameters representing logistic criticalities. They are delivery time and type of transport unit (single or multiple items).

As shown in figure 2, the paths having very short delivery times are those where the delivery is either a service giving adding value (*from POS to POS* and *from POS to customer*) or a key process of the fulfilment (*from CW to customer*). The supply of stores from central warehouse is usually made at great time intervals and with transport units palletized containing multiple items. Whenever possible, you try to aggregate multiple products in the same delivery also in the paths *from CW to customer* and *from POS to customer*. It can be done when the customer buys online several items and the delivery is handled by the same courier.

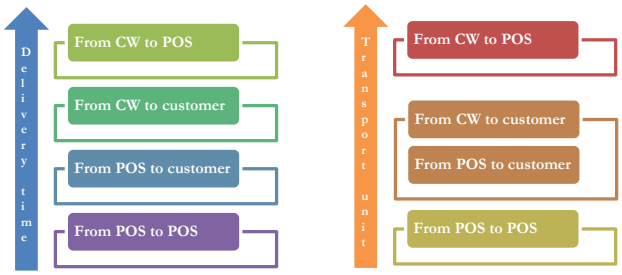

Figure 2: rankings of logistic paths with respect to logistic criticalities

A direct proportionality between delivery time and the number of items composing the transport unit could be outlined: if the delivery time is long, you can more easily optimize transport unit (e.g. by using palletized loads).

3. Inventory management models in innovative retailing systems

Inventory management in innovative retailing systems could be developed based on a *decentralized* versus a *centralized approach*. In a decentralized system, each channel manages independently its inventory and its storage facilities; order fulfilment activities are separated for each channel. This approach is usually applied in multi-channel retailing model. In this kind of systems, one critical issue regards the sales management: in detail, the problem is to define the "best" set of items that have to be sold on the physical retailing channel or in the e-channel (Yan and Pei, 2009, Dan et al., 2012). The main factor influencing this problem is the transportation cost. Bhatnagar and Syam (2014) developed an integer-programming model to identify products that can be profitably withdrawn from the brick and mortar stores and made exclusively available for purchase at the online store. On the other hand, the centralized approach is typical of cross and omni-channel

systems and provides for an integrated management of all the channels. The products may be stored in several locations but a unique virtual inventory works. The system synchronizes all the information and assigns the "best" logistic solution in terms of transportation costs as well as customer service level. In this context, another important issue is the inventory allocation: it refers to design inventory levels for each warehouse and/or point of sale location. Bretthauer et al. (2010) proposed an analytic model for evaluating distributed inventory levels for a company that satisfies both in store and online demand in order to minimize total cost: the main costs analysed are holding, backorder, fixed operating, transportation, and handling costs. A centralized and decentralized approach could be applied to a same path: one example is the "buy online, pick up in store". If a decentralized approach is working, the product bought online is shipped from a central warehouse (where it is available) to the store indicated by the customer for pick up; no control is carried out at the store level to verify the product availability. Therefore, a multi-channel model is implemented. Instead, if cross-channel retailing is applied, central warehouses and stores' inventories are synchronized as a centralized inventory model is working. Thus, the customer chooses a product on the web site; if it is available in the selected store, he can buy it online and pick it up in short time (e.g. less than one hour). Otherwise, the information system verifies in which warehouses (or point of sales) the product is available and a shipping from the nearest location to a specific store is planned. In this context, one important design decision is to identify a subset of stores to be pick up locations for customers. Mahar et al. (2012) proposed dynamic pick up site inclusion policy that incorporates real-time information to specify which of the firm's e-fulfillment locations should be presented at online checkout. By implementing this optimization policy, the firm can protect stores with critically low inventory levels and thereby reduce backorder costs, and eliminate cases where customers arrive at the store and find their order not available. Authors showed that this restricted policy compared with one where all physical stores could be used for pick up determines a reduction of as much as 18% of the total cost function composing by holding, backorder, and lost or redirected pickup sale costs.

By analysing the relationship between inventory management and retailing models, a direct proportionality between investment costs and service level offered to customer emerge. The centralized approach tends to give a very good service, especially in omni-channel systems, but involves high investment costs due primarily to an effective information system. However, the latter leads to a decrease of variable component of operating costs thanks to the optimization of deliveries. Instead, decentralized systems require less investments at the expense of service to customer. Deliveries are not usually optimized in multi-channel retailing. Table 1 shows costs and service level for each retailing model.

Retailing model	Inventory management approach	Service level	Investment costs	Operating variable costs
Single-channel	Decentralized	Low	Low	Medium
Multi-channel	Decentralized	Medium	Medium	High
Cross-channel	Centralized	Medium-high	High	Low
Omni-channel	Centralized	High	High	Low

Table 1: critical analysis of main factors influencing retailing models

4. Return policy models in innovative retailing systems

Handling product returns is a relevant process especially in omni-channel retailing. Products return rates could vary depending on the product category and purchase channel. Online sales face particularly high return rates since customers cannot try and feel the product beforehand (Agatz et al., 2008): returns in Internet retailing have been shown to be, on average, as high as 22% of sales, in contrast with 8.1-8.7% for traditional retailing (Rao et al., 2014). Returns management of products sold online has been debated in literature from different point of view. Verified that returns processing is more than simply a "necessary cost of doing business", Griffis et al. (2012) demonstrated how the returns management process can significantly and positively influence repurchase behavior. Rao et al. (2014) used a large data set of customer purchases and returns to identify how process attributes in physical distribution service influence product returns: availability, expected delivery timeliness and reliability, can contribute to control the occurrence of returns.

All options are available in an omni-channel system. In addition, the simultaneous and integrated management of all channels is a fundamental requirement for all process, return policies included. E.g. brick and mortar stores of multi-channel retailers carry a smaller assortment and they often have to deal with returned items that are not sold in-store and hence have to be shipped back to their warehouses. It happens in decentralized systems. Zhang et al. (2010) outlined the importance of managing effectively return policies: what the optimal return policy should be, which product categories brought from one channel should be permitted to be returned in another channel and whether cross-channel returns should be subject to restocking fees and other charges are the main decision problems.

The return policies currently applied are:

- *return in store* of products bought in store or online;
- *return to a drop off point* of products bought online.
- *ship to firm* of products bought online, i.e. signal online the return of product and ship it to firm's central warehouse;

- *pick up at home* of products bought online;

Return to a drop off point and *pick up at home* are usually outsourced to a logistics provider. Customer usually interact with retailers through web site.

5. Conclusions

The evolution of retailing systems moves towards models providing for an integrated management of traditional stores and mobile channel with the consequent synchronization of physical and information flows. In recent years, retailers are trying to integrate their prevalent retailing channels (physical or virtual) with other channels to be more competitive and increase revenues and want to offer innovative services to customers. On the other hand, consumers have heightened shopping expectations in the era of omni-channel, e.g. 71% expect to view in store inventory online, while 50% expect to buy online and pick up in store (Forrester Consulting, 2014). Hence the new retailing models with specific requirements, i.e. inventory visibility, accuracy of information, control, traceability.

The paper proposes a critical analysis about how the innovative retailing models could impact on operations by focusing on the fulfilment processes, inventory management and return policies, and what are the new approaches to manage them. The study have outlined several new selling structures - such as multi, cross and omni-channel retailing systems - which allow to support different customer service levels. Furthermore, a critical analysis about supply chain structures and logistic paths in new retailing models have been also proposed. Results outlined as the order delivery time is a relevant factor influencing the overall retailing business model and its operations. Delivery times depend on both by the inventory management approach and the specific logistic path. In fact, for example, in order to have a fast delivery, it is necessary a centralized approach allowing to visualize immediately the item positioning and to choice the location nearest to customer. Inventory management in innovative retailing systems could be decentralized or centralized depending on the type of system. The study of literature about inventory management models in this new retailing contexts has been useful to understand the relative issues: selection of products that are suitable to sell online, inventory allocation, selection of a subset of stores to be pick up locations. Main criticalities affecting return policies have been also analysed. Further developments will be oriented to evaluate effective models for design and management of operations in cross-channel and omni-channel retailing systems.

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